

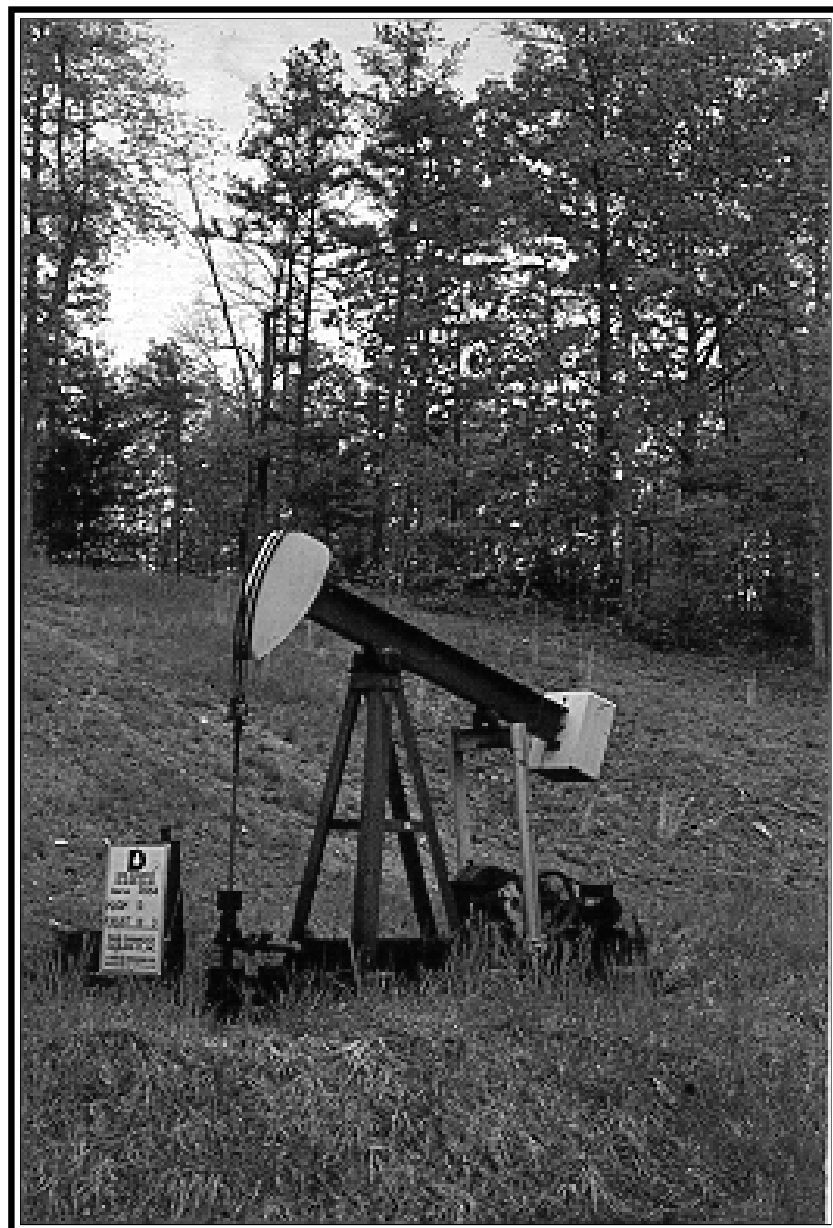
---

Volume 15 No. 1

Tennessee Department of Environment and Conservation  
Division of Geology

March, 2002

---



## TENNESSEE DIVISION OF GEOLOGY NEWS LETTER

VOLUME 15, NUMBER 1

MARCH, 2002

Published semiannually by the Tennessee Department of Environment and Conservation, Division of Geology

**Director's Comments**

by Ronald P. Zurawski

In spite of declining state revenues and a hard freeze on hiring, major equipment purchases (including computers), and out-of-state travel, the Tennessee Division of Geology continues to strive to meet its legislative mandates.

In April 2001 the division published the 2001 Catalogue of Publications and a first reprint of Report of Investigations No. 18, *Late Cretaceous and Subsequent Structural Development of the Northern Mississippi Embayment Area*, by Richard G. Stearns and Melvin V. Marcher. In May 2001 the division published a first reprint of Public Information Series No. 1, *Subsidence and Sinkholes in East Tennessee, A Field Guide to Holes in the Ground*, by Martin S. Kohl. In June 2001 the division produced four publications: a first printing of Report of Investigations No. 49, *Hazardous Trace Elements in Tennessee Soils and Other Regolith*, by Otto C. Kopp; Volume 13 and 14, No. 1 of the *Newsletter*; and first reprints of Report of Investigations No. 17, *Tuscaloosa Formation in Tennessee*, by Melvin V. Marcher and Richard G. Stearns; and Bulletin No. 41, *A Preliminary Report on the Foraminifera of Tennessee*, by J. A. Cushman.

On Sept. 17, 2001, Tennessee joined 21 other states in proclaiming the week of Oct. 7 - 13, 2001, as Earth Science Week in Tennessee. This fourth annual celebration included several activities in Tennessee, including the 2nd Annual Earth Science Fair at the University

of Tennessee Department of Geological Sciences in Knoxville on Oct. 11, and the 3rd Annual Earth Science Week Fossil, Rock, and Mineral Identification Fair at the University Museum on the University of Tennessee at Martin campus on Oct. 12. Please see the related article for more details on this years' activities.

During 2001, we were saddened by the loss of two former chief geologists. Robert E. Fulweiler died in July, followed by Robin C. Hale in December. Please refer to the Personnel Notes section of this newsletter for more details.

The Division of Geology completed an oil and gas well inventory cooperative project with the National Park Service in the Big South Fork National River and Recreation Area in the northern part of East-Central Tennessee. Over the past 10 years, this and other federally funded programs have boosted the Division's revenue by nearly \$330,000.

A new section has been added to our website. Entitled "National Cooperative Geologic Mapping Program (STATEMAP)," this map (pdf) and fact sheet summarizes the division's involvement in this program since 1994.

And finally, the state of Tennessee has changed its e-mail addressing format. For more details, please refer to the Electronic Notes section of this newsletter.

## Marginal Wells Generate \$6.5 Million for Tennessee

The Interstate Oil and Gas Compact Commission (IOGCC) recently released their annual study of U.S. stripper oil and gas wells. "Stripper" wells are marginal, low-volume wells that operate on the lower edge of profitability. IOGCC defines stripper oil and gas wells as those that produce less than 10 barrels of oil or 60 Mcf (thousand cubic feet) of natural gas per day. The commission represents the governors of 30 oil and natural gas producing states. It promotes the conservation and efficient recovery of domestic petroleum resources while protecting health, safety, and the environment.

According to IOGCC, stripper wells nationwide produced more than 313 million barrels of oil in 1999 and generated more than 1.1 billion Mcf of natural gas. In Tennessee, 392 stripper oil wells produced more than 246,000 barrels of oil and 203 stripper gas wells produced more than 1.18 million Mcf of natural gas. Nationwide, the average daily production from stripper wells was only 2.03 barrels and 15.6 Mcf. Stripper wells in Tennessee averaged 1.72 barrels and 16 Mcf per day.

Stripper wells represented about 27 percent of the oil and 8 percent of the natural gas produced in the United States in 1999, excluding Alaska, Florida, and federal offshore facilities, which have no stripper production. Stripper wells represented about 71 percent of the 347,993 barrels of oil and 96 percent of the 1.23 million Mcf of natural gas produced in Tennessee in 1999. This accounted for about 71 percent (\$3.9 million) of the \$5.5 million value of the oil and 94 percent (\$2.6 million) of the \$2.8 million value of the natural gas for a total of about \$6.5 million. Additional production from Tennessee's non-stripper wells brought the combined total to about \$8.3 million.

Severance tax revenue generated from stripper wells in Tennessee totaled \$197,008. Stripper oil

wells generated \$117,817, while stripper natural gas wells generated \$79,191. As a result of the prior year's plugging of stripper wells, a decrease in oil production from stripper wells of 43,938 barrels resulted in an annual loss of severance tax revenue of \$21,039. A decrease in natural gas production from stripper wells of 332,336 Mcf resulted in an annual loss of severance tax revenue of \$22,236, for a total annual loss of severance tax revenue of \$43,275 in 1999.

Nationwide, 11,227 stripper oil wells and 3,541 stripper natural gas wells were plugged and abandoned in 1999. In Tennessee, about 127 (70 oil and 57 natural gas) of the 135 wells that were plugged and abandoned were stripper wells.

The United States is the only country that has significant stripper petroleum production. By extracting small amounts of oil and gas, stripper wells help conserve the nation's energy reserves by ensuring the maximum amount of the resource is recovered. Once these wells are plugged, access to remaining reserves is often lost, since re-drilling the wells is usually not cost-effective.

Although small, the contribution of stripper gas wells is especially important, since, according to the U.S. Department of Energy, climate change concerns are expected to significantly increase future demand for natural gas as a transportation and home heating fuel. The U.S. Department of Commerce, Bureau of the Census reports that currently, two-thirds of new homes built utilize natural gas heat. The Energy Information Administration also projects that globally, natural gas usage will grow faster than any other primary energy source. Much of this will be to fuel electricity generation, especially in industrialized countries where natural gas can replace other fossil fuels used for this purpose.

## Oil and Gas Notes

**Permitting Activity:** Oil and gas well permitting activity decreased by slightly more than two percent during 1999. A total of 138 permits were issued, compared with 141 in 1998. Nine counties had permitting activity, one less than in 1998. Overton, Pickett, Campbell, and Hancock were the most active. Overton had 91, Pickett had 24, and Campbell and Hancock were tied for third, with six permits each. The remaining five counties were Claiborne—3, Fentress—3, Scott—3, Hawkins—1, and Morgan—1. With more than 83 percent of the permits issued in 1999, Tennessee's Eastern Highland Rim (Overton and Pickett Counties) continued to overshadow the Cumberland Plateau in terms of permitting activity. Permitting on the Cumberland Plateau (Scott, Morgan, Claiborne, Fentress, and Campbell counties) increased considerably from 1998, with nearly 11.6 percent of the total. There were seven wells permitted in the Eastern Overthrust area of Tennessee, but none in West Tennessee.

**Oil and Gas Well Completions:** The Tennessee Division of Geology classified 107 oil and gas tests during 1999, a 14.4 percent decrease from the 125 that were classified in 1998. These included 69 new field wildcats, 33 development wells, and five outposts. There were 24 oil wells, seven gas wells, two dual completions, and 74 dry holes. The overall success rate was 31 percent, down from 36 percent in 1998. The success rate for new field wildcats was 26 percent, for development wells more than 42 percent, and for outposts 20 percent. Total drilling footage reported was 193,418 feet, down from 231,690 feet in 1998.

Five oil and gas tests with larger than average initial production were completed during 1999. The first was a new field wildcat in Overton County. It had initial production

*(Continued on p. 8)*



Department of Environment and Conservation,  
Authorization No. 327921. 4,000 copies. This  
public document was promulgated at a cost of  
57¢ per copy. May, 2001.

## Mineral Notes

**Coal Production:** The Energy Information Administration (EIA) (U.S. Department of Energy) estimates that Tennessee's coal production during 1999 was 3.037 million short tons (ST), a 12.6 percent increase over the 2.696 million ST produced during 1998. This reverses a downward trend that began in 1997. Coal production value was approximately \$88.8 million, up from the 1998 value of approximately \$77.35 million. Production came from 24 mines in eight counties. Thirteen of these were underground mines, and 11 were surface. The underground mines accounted for 49 percent of total production, while surface mines were responsible for 51 percent. All of this was medium- and high-volatile bituminous. Recoverable reserves at producing mines were 14 million ST. Average recovery was 67.65 percent for all mines. Average Btu value of coal received at electric utilities was 11,635 per pound, down from 11,733 in 1998. Average Btu value of coal received at manufacturing and coke plants was 13,052 per pound, up from 13,013 in 1998.

**Coal Mining Employment:** The average number of miners employed during 1999 was 566, up from 533 in 1998, and down from 2,240 in 1986. Underground miners totaled 300, while there were 266 surface miners. All of these were non-union.

**Coal Reserves:** The EIA estimates Tennessee's demonstrated reserve base of coal to be 816 million ST as of January 1, 1997. Of this, 284 million ST are surface, and 532 million ST are underground. Recoverable reserves are estimated to be 484 million ST; 193 million ST are surface, and 291 million ST are underground.

**Nonfuel Mineral Production:** The U.S. Geological Survey, in their Mineral Industry Survey for Tennessee, estimated that the value of Tennessee's nonfuel mineral production in 1999 was \$710 million, a one percent increase over the 1998 figure of \$705 million. Tennessee continued to rank 20th nationally in the total value of nonfuel minerals produced, and accounted for about two percent of the U.S.

*(Continued on p. 9)*

## **Earth Science Week Celebrated in Tennessee**

On Sept. 17, 2001, Governor Sundquist officially proclaimed the week of Oct. 7 - 13, 2001, as Earth Science Week in Tennessee. Tennessee joined 21 other states and city mayors across the nation in recognizing the importance of this fourth annual celebration of the earth sciences.

Earth Science Week provides a focus on the earth sciences that enables organizations such as state geological surveys, universities, and the U.S. Geological Survey to heighten public awareness about the importance earth science plays in each of our lives by sponsoring field trips, open-houses, workshops, and other activities and programs. Earth Science Week was one of a number of 50th anniversary initiatives for the American Geological Institute (AGI), a federation of 39 professional earth science organizations. It is also supported by the Association of American State Geologists, the Geological Society of America, and the National Science Foundation. AGI's role in sponsoring an annual Earth Science Week is to provide a clearinghouse for ideas, activities, and special events, and to provide support materials that make it easy for geoscientists to participate. Since the celebration's founding in 1998, more than one million students have participated, and Earth Science Week materials have been used in over 25,000 classrooms. At the local level, this effort is supported by Tennessee earth science teachers, by geoscience departments at Middle Tennessee State University, Tennessee Technological University, the University of Memphis, the University of Tennessee's Chattanooga, Knoxville and Martin campuses, the University of the South, Vanderbilt University, and by the Tennessee Division of Geology, among others. Information about Earth Science Week is available on the internet at: <[www.earthscienceworld.org](http://www.earthscienceworld.org)>.

Two main events took place during Earth Science Week 2001 in Tennessee. The University of Tennessee (Knoxville) Department of Geological Sciences was the site of the 2nd

Annual Earth Science Fair on Oct. 11. Volunteer students, faculty, and staff from sponsoring organizations provided displays, demonstrations, and hands-on activities. Teachers, parents, middle and high school earth science students from Knox and surrounding counties were invited to participate. School group activities were organized into five morning and five afternoon sessions. More than 1,000 people attended the event, which covered the following topics: Martian geology, Lunar geology, gold panning, groundwater models, physical geography, Tennessee geology, geoscience careers, earthquakes, meteorite impacts, geologic time, fossils, and much more. The event provided participants with the opportunity to discover different facets of Earth Science, raise awareness of Earth Science's impacts on everyday life, and encourage stewardship of the Earth through an understanding of Earth processes. Sponsors participating in the fair included: UT Department of Geological Sciences, Tennessee Division of Geology, UT College of Arts & Sciences, UT Department of Geography, Tennessee Geographic Alliance, East Tennessee Geological Society, Knoxville Gem and Mineral Society, Tennessee Earth Science Teachers, and local businesses.

The University of Tennessee at Martin Department of Geology, Geography, and Physics held its 3rd Annual Earth Science Week Fossil, Rock and Mineral Identification Fair on Oct. 12. This year the fair coincided with a museum exhibit entitled "The Story of West Tennessee's Clay Mines, 1894-2001: Mules to Microscopes, fossils to Porcelain." Both the museum exhibit and identification fair were held at the University Museum on the UT Martin campus. The museum exhibit was open to the public Oct. 1 through Oct. 31. Volunteer students from the UT Martin GeoClub and Sigma Gamma Epsilon Honor society, geology faculty, and staff were on hand on Friday, Oct. 12 to help identify fossils, rocks, and minerals and answer questions about them.

## Cooperative Project Activities

The Division of Geology received more than \$13,000 under U. S. Geological Survey (USGS) Cooperative Agreement No. 99HQAG0156 for fiscal year 2000-2001. This award was provided under the National Coal Resources Data System program. Activities for last year included compilation and digitization of coal data, revision of coal reserve estimates for the Tennessee coal field, and support for the new National Coal Resource Assessment, under which 1:24,000-scale coal maps and supporting information were provided for the Windrock and Blue Gem (Rich Mountain) coal zones over an area that includes approximately 16 quadrangles. This was a continuation of funding for a long-term, Division of Geology-managed project to systematically revise, one quadrangle at a time, coal reserve maps and reserve estimates for selected areas in the Tennessee coal field. Our ultimate goal is to publish an up-to-date coal reserve estimate for Tennessee's 20 coal-bearing counties that can be periodically revised and updated as required. Division personnel involved in this project are geologist 3 Elaine Foust, geologist 3 Barry Miller and secretary Becky Hawkins of the division's Knoxville office, and state geologist Ron Zurawski.

The Division of Geology has also been approved for \$10,000 in funding under the same USGS cooperative agreement for fiscal year 2001-2002. This is the 10th year the division has been funded under this program, through which we have received nearly \$103,000.

The Division of Geology also received more than \$27,000 under USGS Cooperative Agreement No. 00HQAG0111 for Fiscal Year 2000-2001 under the State Geological Mapping Program element (STATEMAP) of the National Geologic Mapping Program. STATEMAP is a federal grant program designed to assist the states in accelerating the process by which geologic maps are made available to the general public.

The purpose of this project was to map the Sweetwater, Tennessee 7.5-minute Quadrangle

in McMinn and Monroe counties; the Philadelphia, Tennessee 7.5-minute Quadrangle in Loudon, McMinn, and Roane counties; and the Cave Creek, Tennessee 7.5-minute Quadrangle in Loudon and Roane counties. The funds supported a contract with John W. Jewell, an independent consulting geologist, who was responsible for Sweetwater; and mapping by staff geologists Martin Kohl and Peter Lemiszki of the division's Knoxville office, who were responsible for Philadelphia and Cave Creek, respectively.

Jewell was previously contracted to map the Lenoir City Quadrangle in Loudon and Roane counties; the Bristol Quadrangle in Sullivan County; the Johnson City Quadrangle in Carter, Unicoi, and Washington counties; the Jonesborough Quadrangle in Washington County; and the Loudon Quadrangle in Loudon and Monroe counties, Tennessee. He previously published seven geologic maps under the Division of Geology's mapping program, and was a contributor to the State Geologic Map of Tennessee. He was selected for last year's project through the state's competitive bidding process.

The Division of Geology has also been approved for \$60,000 in STATEMAP funding under USGS Cooperative Agreement No. 01HQAG0108 for fiscal year 2001-2002. This is the seventh year the division has been approved for funding under this program, through which we have received more than \$98,000.

The purpose of this year's project will be to map the Jackson North, Tennessee 7.5-minute Quadrangle in Madison County; the Sullivan Gardens, Tennessee 7.5-minute Quadrangle in Sullivan and Washington counties; and the Leesburg, Tennessee 7.5-minute Quadrangle in Washington County. The funds will be used to support a contract with John W. Jewell, who will be responsible for Jackson North; and mapping by staff geologists Martin Kohl and Robert Price of the division's Knoxville office, who will be responsible for Sullivan Gardens and Leesburg, respectively.

*(Continued on p. 7)*

## Personnel Notes

On July 1, 2001, former chief geologist Robert E. Fulweiler died at the age of 72 in Jefferson City, Tennessee, after a prolonged illness. Mr. Fulweiler was born May 30, 1929, in Litiz, Pennsylvania. After earning a BA degree in geology from Duke University in 1951 and a MS degree in geology from Ohio State University in 1957, he moved to Jefferson City to assume a position as geologist with New Jersey Zinc Company. During his tenure with New Jersey Zinc, he was promoted to resident geologist in 1968 and to regional geologist in 1976. In 1985, he accepted the position of chief geologist for the Tennessee Division of Geology's East Tennessee regional office in Knoxville. He retired from the state in 1996.

On Aug. 14, 2001, the Division of Geology was successful in upgrading its gas and oil field inspector positions to environmental specialist 3. The upgrade took effect on Oct. 2, 2001, and involved Glenn Burke and Jeffry Laxton. Glenn has a Bachelor of Arts degree in biology from Berea College in Berea,

Kentucky. He has been with the division since May of 2000, with nearly 12 years of prior state service, and also participated in the Tennessee Emergency Management Agency's Emergency Response Team. Jeffry came to the State Oil and Gas Board in April of 1997, with more than seven years of oil and gas well drilling and completion experience, including hazardous materials handling and transportation. He also has nearly eight years of law enforcement experience, including emergency response activities.

This upgrade accomplishes a number of things. It brings the State Oil and Gas Board's inspection program in line with other regulatory programs within the Department of Environment and Conservation, making it easier to attract better-qualified candidates when job vacancies occur. It supports an objective of the Department's 4-Year Strategic Plan, which is to continue to evaluate job classifications in order to make recommendations to the Department of Personnel. And finally, it eliminates a class title for which there were only two authorized positions statewide, in support of an objective the Executive Branch Strategic Plan, which is to simplify the job classification structure.

---

### **Cooperative Project Activities** *(Continued from p. 4)*

Work was completed on a \$42,250 cooperative agreement with the National Park Service/Big South Fork National River and Recreation Area for collecting, analyzing, and reporting oil and gas well site characteristics and non-federal owner/operator information. In addition to financial support, Big South Fork provided a GPS unit for use during the project, as well as inventory sheets and the Microsoft Excel-compatible spreadsheet structure that were used in the final report. This project was designed to provide a site-by-site inventory of the park's 300 oil and gas operations and associated environmental impacts, as well as an updated list of mineral owners and operators within the park. In addition to being mapped, each site was photographed using video and still cameras.

On Dec. 4, 2001, former chief geologist Robin C. Hale died at the age of 65 in Knoxville, Tennessee. Mr. Hale was born on Sept. 29, 1936. After earning a BA degree in chemistry from the University of Chattanooga in 1958 and a MS degree in geology from Virginia Polytechnic Institute in 1961, he began his career as a geologist with the Virginia Department of Highways. In 1963 he went to work for the Tennessee Valley Authority, where he stayed until 1988, when he opened his own business as a consulting geologist. In 1992 he joined the staff of the Division of Geology as a geologist 2, where he served until his promotion to chief geologist for the Tennessee Division of Geology's East Tennessee regional office in Knoxville in 1996. He retired from the state in 1999.

## Oil & Gas Notes *(Continued from p. 4)*

of 2400 barrels of oil per day from the Nashville Group. The second was a new field wildcat in Hancock County. It had initial production of 360 barrels of oil per day from the Stones River Group. The third was a development well in the Black Hollow Field in Overton County. It had initial production of 96 barrels of oil per day, also from the Stones River Group. The fourth was a development well in the Good Hope field, also in Overton County. It had initial production of 40 barrels of oil per day from the Fort Payne. The last was another new field wildcat in Overton County. It had initial production of 20 barrels of oil and 20 Mcf of gas per day from the Nashville Group.

**Oil Production:** Oil production totaled 347,993 barrels during 1999, an increase of 13.9 percent from 305,597 barrels in 1998, reversing a decline from Tennessee's all-time high of more than one million barrels in 1982. The average price per barrel increased to \$15.93, up from \$11.08 per barrel in 1998, but down from Tennessee's all-time high of more than \$35 per barrel in 1981. Total value increased to more than \$5.5 million, up from less than \$3.4 million in 1998, but down from Tennessee's all-time high of more than \$35 million in 1982. Thirteen counties reported production, one more than in 1998. Overton County remained the leader, with 112,108 barrels, or more than 32 percent of the state's total. Scott County remained in second place, with 63,420 barrels; and Morgan County remained in third place, with 55,275 barrels. Tennessee's most productive oil well was Young Oil Corporation's Rural and Nancy Peace No. 4, a new field wildcat in Overton County. It produced a total of 22,918 barrels in 1999, with a market value of more than \$365,000. Cumulative production is 31,753 barrels from the Fort Payne Formation since July of 1998. Cumulative production for the entire State now stands at nearly 18.5 million barrels, with an estimated total value of more than \$350 million.

**Gas Production:** Gas production decreased by 13.1 percent, to 1.23 billion cubic feet (Bcf), down from 1.42 Bcf in 1998, continuing a decline

from Tennessee's all-time high of 5.02 Bcf in 1984. The average price increased, to \$2.23 per thousand cubic feet (Mcf), down from \$2.16 per Mcf in 1998, and from Tennessee's all-time high of \$3.50 per Mcf in 1984. Total value decreased, to less than \$2.8 million, down from nearly \$3.06 million in 1998, and from Tennessee's all-time high of more than \$12 million in 1984. Production came from six counties, the same as in 1998. Claiborne County remained the leader, with 420,816 Mcf, or more than 34 percent of the State's total. Scott County remained in second place, with 335,990 Mcf; and Morgan County remained in third, with 298,609. Tennessee's most productive gas well was Daniel F. Potts' Walls Properties Unit No. 2 in Morgan County. It produced a total of 24,442 Mcf in 1999, valued at approximately \$55,000. Cumulative production is 151,524 Mcf from the Stones River Group since February of 1995. Cumulative gas production in Tennessee is now more than 98 Bcf, with an estimated total value of more than \$105 million.

**Gas Consumption:** According to the Energy Information Administration, natural gas consumption in Tennessee during 1999 was 276.47 billion cubic feet (Bcf). Of this 60.56 Bcf was used by residential, 52.57 Bcf by commercial, and 144.64 Bcf by industrial consumers. Lease fuel accounted for 26 Bcf, pipeline fuel for 15.21 Bcf, and vehicle fuel for 9 Bcf, while electric utilities used 3.45 Bcf. Residential consumers totaled 937,896, commercial totaled 112,978, and industrial totaled 2,328. The average annual consumption per residential consumer was 64.6 thousand cubic feet (Mcf), per commercial consumer was 465 Mcf, and per industrial consumer was 62,130 Mcf. Residential consumers paid an average of \$6.53 per Mcf, commercial consumers an average of \$5.73 per Mcf, and industrial consumers an average of \$3.72 per Mcf. Pipeline fuel averaged \$2.04 per Mcf, and vehicle fuel averaged \$5.08 per Mcf. Total supply from all sources was 3.35 trillion cubic feet.

**Oil and Gas Board Activity:** Three general hearings were held by the State Oil and Gas Board during 1999. On January 8, the Board reviewed a request by Pegasus Energy Re-



sources Corporation for conversion of the Indian Creek Field to a secondary oil recovery project and gas storage field, including the establishment of a protective zone around the field for the purpose of protecting the interests of the operator and public service company leases, the distance such protective zone may extend beyond the established area of the gas storage field, and the rights of the operator and landowners regarding the oil and gas wells within the protective zone. On March 26, the Board continued to review the conversion request. On May 14, the Board determined that Pegasus Energy Resources Corporation could proceed with the conversion project, since it fell within the terms of the field wide order that was originally approved for the Indian Creek Field in 1977. The Board also agreed to continue for later consideration the request for the establishment of a protective zone around the Indian Creek Field. No rulemaking hearings were held in 1999.

**Sample Processing:** The Tennessee Division of Geology processed 108 sets of well cuttings during 1999, representing drilling footage of 169,066 feet; down from 182,755 feet in 1998, when 108 sets were also processed. During the past 10 years, the division has processed more than 1,234 sets of well cuttings, representing drilling footage of 1,929,705 feet. Sample processing is done by 48-year veteran, Calvin Pernell, at the division's Montgomery Bell State Park sample processing lab. The division currently has processed sample sets available for study for nearly 5,900 wells.

**Computerized Oil and Gas Data Base:** A total of 111 wells were added to the division's computerized oil and gas data base in 1999, up from the 78 that were added in 1998. The data base contained information on 10,593 wells at the end of 1999. A complete printout is available from the division's maps and publications sales office at a cost of \$65.00. Printouts of selected data categories such as county, field, type of completion, or combinations of categories are also available on 24-hour notice. Cost of these custom printouts varies with the amount of information selected. The data base is also available in electronic format for \$300.

total nonfuel mineral production value. Tennessee continued to lead the nation in the value of gemstones and ball clay produced, remained in second place in zinc production, was in third place in barite production, and 10th place in the production of crushed stone and industrial sand and gravel. The State also ranked 10th in the production of primary aluminum, all of which was produced from materials imported from other domestic and foreign sources.

Crushed stone production was 64 million metric tons (MT), a slight increase over 63.6 million MT produced in 1998. The value of crushed stone produced was \$383 million, an increase of 3.5 percent over the 1998 value of \$370 million. Crushed stone continued to be the State's leading nonfuel mineral commodity, a position held since 1981. It accounted for 54 percent of the State's total nonfuel mineral production value. The major rock types quarried to produce crushed stone were dolomite, granite, limestone, and sandstone.

Ball clay production was 719,000 MT, a one percent increase over the 712,000 MT produced in 1998. The value of ball clay produced was \$30.8 million, a 2.3 percent increase over the 1998 value of \$30.1 million.

Construction sand and gravel production was 9.74 million MT, a 3.5 percent increase over 9.41 million MT produced in 1998. The value of construction sand and gravel produced was \$52.5 million, a 5.4 percent increase over \$49.8 million in 1998.

Industrial sand and gravel production was 1,050,000 MT, a 5.1 percent increase over 999,000 MT produced in 1998. The value of industrial sand and gravel produced was \$18.9 million, a 10.5 percent increase over \$17.1 million in 1998.

Tennessee was one of two states in the nation that produced cadmium as a by-product of the refining of domestically mined zinc ore. The cadmium was recovered during the smelting and refining process of zinc concentrates.

In 1999, a total of 303 non-fuel mineral op-

erations were registered in 80 counties across the state of Tennessee.

**Ball Clay, Clay, and Fullers Earth:** Ball Clay was mined by the Gleason Brick Co., H.C. Spinks Co., Kentucky-Tennessee Clay Co., Old Hickory Clay Co., and Unimin Corp. in West Tennessee. General Shale Products Corp. operated nine mines in four counties in East Tennessee to supply its brick production plants. General Shale Products joined the Wienerberger Group headquartered in Vienna, Austria in July 1999. Fullers Earth was mined in West Tennessee in Hardeman County by Molten Co.

**Barite:** Yates Construction Co. owns barite mines in McMinn and Monroe counties. The open pit mines produce pharmaceutical grade barite, but only the McMinn Mine was in production.

**Construction Sand and Gravel:** Construction sand and gravel was produced in 31 counties at 92 sites operated by 57 different companies. Companies operating five or more sites included: Ford Construction Co., Memphis Stone and Gravel Co., and Standard Construction Co. in District 1 (West Tennessee), and Bradley Stone and Gravel Inc. in the eastern part of District 2 (Middle Tennessee).

**Crushed Stone:** Tennessee's crushed stone industry had the widest production distribution and produced limestone and dolomite, except the Maymead Lime Co., which produced crushed granite in Johnson County. Crushed stone was produced in 64 counties by 63 different companies, 18 of which were operated by county governments. The top three producers were (1) Vulcan Materials Co., which operated 33 quarries in 24 counties; (2) Rogers Group, Inc., which operated 25 quarries in 22 counties; and (3) American Limestone Co., which operated 8 quarries in 5 counties.

**Dimension Stone:** The Tennessee Marble Co. quarried Holston Marble for dimension stone from Blount County, and the Imperial Black Marble Co. produced dimension stone from the Maryville Limestone quarry in Grainger County. Quartzitic sandstone was

quarried on the Cumberland Plateau for dimension stone, flagstone, and ashlar. Although there are a number of individuals who independently quarry the sandstone, no quarries were registered with the state in 1999.

**Gems:** The American Shell Co. and the Tennessee Shell Co. harvested mollusk shells from the Tennessee River and sold crushed shells for seeds in the cultured-pearl industry. The American Pearl Co. farmed pearls in the Tennessee River in Benton County.

**Gold:** The Coker Creek gold district in Monroe County suffered a loss when the main structure at Coker Creek Village was destroyed by fire in the fall of 1999. Coker Creek Village supported the local economy by attracting tourists to pan for natural gold in Coker Creek. Plans are to rebuild and continue the gold panning for a fee operation.

**High-Calcium Limestone:** Lime plants operated by Bowater Southern Paper Corp. in McMinn County and Global Stone Tenn-Luttrell, Inc. in Union County produced high-calcium quicklime and high-calcium hydrated lime. Global Stone Tenn-Luttrell was owned by Global Stone Corp., which was acquired by Oglebay Norton Co. in a stock purchase in the spring of 1998.

**Industrial Sand:** Three active operations mining high-silica sand were in Carroll, Hawkins, and Madison counties. Short Mountain Silica Co. operated the only mine in East Tennessee, and Unimin Corp. and U.S. Silica Co. operated mines in West Tennessee.

**Zinc:** Grupo Mexico S.A. de C.V. purchased from ASARCO Incorporated four zinc mines in Knox and Jefferson counties: the New Market, Young, Immel and Coy Mines. The New Market Mine continued on standby status. The Young, Immel, and Coy Mines operated at 4,200 metric tons per day (t/d), 1,900 t/d, and 1,130 t/d, respectively.

In February 1999 Pasminco Ltd. completed the takeover of Savage Resources Ltd. and acquired the electrolytic zinc plant in Clarksville and underground mines at Gordonsville and

**Mineral Notes** (Continued on p. 11)

## University Geology News

### **From East Tennessee State University Department of Geography, Geology, and Geomatics**

The department recently hired Dr. Steven C. Wallace as a full-time faculty member, bringing the total number of full-time geology faculty to four. His expertise is in Paleontology, and he will be helping to organize the new fossil site near Gray, Tenn. Dr. Wallace received a BS degree in Geology from Bowling Green State University in Bowling Green, Ohio; an MS degree in Geology from Fort Hays State University in Hays, Kan.; and a Ph.D degree in Geoscience (disciplinary specialization of Vertebrate Paleontology) from the University of Iowa in Iowa City, Iowa. The ultimate goal of his research is paleoenvironmental reconstruction of Miocene through Pleistocene-aged mammalian fossil assemblages. He is focusing on mammals because they are second only to birds in modern (terrestrial) vertebrate diversity, but unlike birds have an extensive fossil record in North America. In addition,

Miocene-Pleistocene faunas exhibit strong correlation to modern ecosystems worldwide.

The department recently expanded its Geographic Information System processing laboratory. It is among the largest for a university in Tennessee, and has been in existence since 1993.

### **From University of Tennessee, Chattanooga: Department of Physics, Geology, and Astronomy**

The department takes its students for a field trip experience every year. This year the geology students at UTC will examine the geology of the desert southwest, Arizona, California, Nevada, and Utah.

### **From University of Tennessee, Martin: Department of Geology, Geography, and Physics**

During the past year, the department reorganized and upgraded its Geology and Physics labs to make better use of limited lab and office space. This included the purchase of new computers, lab material, and minor equipment. The department also upgraded and expanded its Geographic Information Systems (GIS), Cartography, and Remote Sensing computer lab. This involved a move to larger quarters, plus the acquisition of additional computers, bringing the number of seats in the lab to 15. The department also acquired 15 site licenses for ArcView 3.2 GIS software, for Idrisi 32, a GIS and image-processing software package, and for Micrografx, a computer-assisted design program for cartography. In addition, the department upgraded the ArcView Spatial analyst extension and purchased two Global Positioning System receivers and a HP 720 inkjet printer.

There are currently 15 Geology and 10 Geography majors. Eight students graduated during the 2000-2001 academic year.

Michael Gibson serves as the State Science Framework (Geology and Earth Sciences)

---

### **Mineral Notes** *(Continued from p. 10)*

Clinch Valley. Prior to the takeover, in the spring of 1998, Savage Zinc Inc. announced plans for a \$400 million expansion of the Clarksville Zinc Plant (The Oak Ridger, 1998). The Clarksville Zinc Plant was commissioned in 1979 and operates at approximately 95,000 metric tons per year, which accounts for 28 percent of U.S. zinc production. The plant is one of two companies in the United States that produces primary cadmium as a byproduct during roasting and leaching of the zinc concentrate. The mines at Gordonsville (including the Elmwood and Cumberland Mines) in Smith County produce the highest-grade zinc concentrate in the world at 64.5 percent and are also one of the largest sources of germanium in the world. The Clinch Valley Mine in Grainger County was reopening after being on standby for care and maintenance.

Coordinator for the Tennessee State Department of Education and as a Tennessee Earth Science Teachers Higher Education Advisor.

Dr. Jefferson Rogers, Assistant Professor of Geography, recently received the University of Tennessee National Alumni Association Outstanding Teacher Award. Dr. Tahira Arshed, Professor of Physics, was selected to lecture at the University of Hirosaki, Japan in June and July 2001 as part of an exchange visitor program. She also received a Fulbright Fellowship and an Alma & Hal Reagan faculty development award to lecture and conduct research at the University of Peshawar, Pakistan during the academic year 2001-2002. A total of \$75,594 was received by faculty members during the past year to carry out research, develop courses, and attend workshops.

### **From University of Tennessee, Knoxville: Department of Geological Sciences**

#### **Asteroids Named for Two UT Geologists:**

Two UT geology professors have joined the likes of The Beatles and Carl Sagan in orbit - literally. In January 2001 Dan Britt and Hap McSween were notified by the Smithsonian Institution that they now have large asteroids named in their honor. Asteroid 1981 EH41 is now DanBritt, and asteroid 1981 EX6 is McSween. Both asteroids, with diameters of 13 and 7 kilometers, respectively, are in orbit about midway between earth and Jupiter.

**Departmental Name Change:** With the 10-year program review coming up this April for the department, the faculty met in mid-August to discuss our situation. We decided to recognize our strengths and pitch them in the review process to see if we could garner both a strong endorsement from the review team and a basis for increased support from the institution. During the process, we struggled with maintaining classical strengths while recognizing new potentials. As a result, the faculty decided to recommend a name change for the department to Department of Earth and Planetary Sciences. We opted for "Earth" over "Geological" to recognize our developing

strength in soils and groundwater, and opted to add "Planetary" to recognize an existing strength that has many excellent possibilities. This name change will be accompanied by a significant revision in the undergraduate curriculum, will gain access to new pools of potential graduate students, will drive our priorities for faculty hiring, and will indicate pathways to larger funding opportunities. We have much hard work to do before April in terms of fleshing out the implications of the name change.

**Petroleum Industry Recruiting:** For several years, the department has worked to improve its hiring links for its students to the petroleum industry. This has been tough with industry consolidation, wildly varying hydrocarbon prices, and the existing distribution of our alumni in industry, but we have been determined to try. This year has seen a small glimmer of success with the continuing recruiting visits of ExxonMobile, the addition of recruiting visits by Phillips and Schlumberger, and the sending of students to the fall AAPG Student Expo. Results are still incoming, but we have had enough success that some students are pausing on their pre-determined paths to consider this hiring possibility. They are weighing such things as work type to compensation to job security. We will see how that develops. The department has a continuing commitment to finding the greatest variety of interesting employment for its grads.

**Leonard Medal to Hap McSween:** Hap McSween continues to earn well deserved recognition for his scientific contributions. The Meteoritical Society awarded Hap their prestigious Leonard Medal at their annual meeting in Rome, Italy in early September for his work on Martian meteorites and his success at communicating science to the public. It has been five years since an American has won this award. This work has provided both a continuing interest for Hap, his students, and his postdocs, and the platform for his significant involvement in the science investigations of NASAs suite of satellites orbiting and landing on Mars.

**Marvin Bennett Leaves:** For those who graduated from or have been involved with the department through the 1990's and early '00's," Marvin Bennett has been a fixture. His role, be it student, postdoc, instructor, or lecturer, has not mattered because he has always given his all to the department and its many citizens. Marvin has never shown an understanding for the word "No," when people have come asking for help with teaching, learning, organizing, or Mac computers. Marvin's good fortune is that he has been offered and accepted a tenure-track assistant professor position at a satellite campus of Texas A&M in Laredo, where an old pal of his and another alumnus of the department, Ken Tobin, is also a faculty member.

**Newest faculty Member:** The newest faculty member to join the department is Edmund Perfect, an Englishman via Canada, whose specialty is soil physics. His hire adds both to the environmental program and the growing research into modern and ancient soils. He and his wife, Barbara, are settling into Knoxville suburbia after a stint on a small farm outside of Lexington, Kentucky.

**December Graduates:** The department had a bumper crop this year through a combination of graduate students working hard to finish back in late August and undergrads completing after taking fieldcamp. In some respects, December has become a more common graduation time than May because of the need to complete the thesis or fieldcamp. December's graduates earned nine bachelor's degrees, five master's, and three Ph.D degrees. These graduates are going on to employment in environmental, geotechnical, petroleum industry, and graduate school positions, as staff scientists at research labs and postdocs, plus a couple are continuing with jobs that they already have.

### **From Vanderbilt University: Department of Geology**

Dr. Bill Seisser spent two months aboard the Joides Resolution last summer (July-August, 2001) as a member of the USA Ocean Drilling Program (ODP) Leg 197 team. The ODP

is an international program made up of the USA, Britain, France, Germany, Japan, Canada-Australia, and the European Science Foundation (12 smaller European countries) as partners. Each partner country sends scientists on each ODP geological oceanographic expedition.

ODP Leg 197 drilled and cored the Emperor Seamounts, a chain of extinct submerged volcanoes that extends from near the Siberian Kamchatka Peninsula southward to the Hawaiian Islands. The mission of the expedition was to test the "fixed hotspot" hypothesis. This hypothesis states that narrow jets of hot material rise through the interior of the Earth as "mantle plumes," reaching the surface at points called "hotspots." The heat sources remain permanently fixed within the earth's interior, with the lithospheric plates passing over them. The classic example of a fixed hotspot (and the example used in most introductory geology and oceanography textbooks) is the Emperor-Seamount-Hawaiian ridge. A kink in this continuous chain of seamounts occurs northwest of Midway Island, and has long been believed to indicate a dramatic change in the direction of Pacific Plate motion about 43 million years ago (Ma).

During Leg 197, maximum drilling depth was achieved on the northernmost portion of the seamount chain, where 462 m of sediment and 453 m of basalt and volcanoclastic sediments were cored. Water depth is 2,593 m at the site. Paleomagnetic paleolatitude and age evidence obtained at this site and additional sites to the south indicate that the fixed hotspot hypothesis, at least with regard to the Emperor Seamount chain, needs to be revised. The Emperor-Hawaiian hotspot moved southward at an average rate of 30 to 50 km/m.y. from about 80 Ma to about 43 Ma. This means that the kink in the seamount chain does not indicate a change in Pacific Plate direction of movement, and that the direction has been essentially west-northwest for the last 80 m.y.

## Electronic Notes

### New E-Mail Addresses

The state of Tennessee has changed its e-mail addressing format. State employees are being asked to update all business correspondence to reflect the new Internet e-mail addresses prior to Nov. 2002. However, e-mails that are sent to old aliases will continue to work until Jan. 2003. This change will allow all users within the state's e-mail system to be assigned an Internet e-mail address. New e-mail addresses for division staff are as follows:

Marvin Berwind: Marvin.Berwind@state.tn.us  
 Mike Burton: Michael.K.Burton@state.tn.us  
 Elaine Foust: Elaine.Foust@state.tn.us  
 Tom Hart: Tom.Hart@state.tn.us  
 Becky Hawkins: Becky.Hawkins@state.tn.us  
 Albert Horton: Albert.Horton@state.tn.us  
 Mike Hoyal: Mike.Hoyal@state.tn.us  
 Martin Kohl: Martin.Kohl@state.tn.us  
 Tammy Jackson: Tammy.Jackson@state.tn.us  
 Cheryl Karolchik: Cheryl.Karolchik@state.tn.us  
 Pete Lemiszki: Peter.Lemiszki@state.tn.us  
 Barry Miller: Barry.Miller@state.tn.us  
 Jim Moore: Jim.L.Moore@state.tn.us  
 Chris Moxon: Chris.Moxon@state.tn.us  
 Doris Noble: Doris.Noble@state.tn.us  
 Carolyn Patton: Carolyn.Patton@state.tn.us  
 Gary Pinkerton: Gary.Pinkerton@state.tn.us  
 Bob Price: Bob.Price@state.tn.us  
 Sharon Watkins: Sharon.M.Watkins@state.tn.us  
 Ron Zurawski: Ronald.Zurawski@state.tn.us

Questions of a geologic nature must now be directed to the division at the following address: <ask.geology@state.tn.us>.

Questions regarding maps and publications or an online order must be directed to: <geology.sales@state.tn.us>.

### Expanded Web Site

The division's web site was recently expanded to include a new section. The latest, entitled "National Cooperative Geologic Mapping Program (STATEMAP)," includes

a map (pdf) that shows where STATEMAP-funded mapping has been completed and fact sheet that lists state-specific benefits and reasons for STATEMAP, the funding that STATEMAP has provided to Tennessee, and a summary of the division's involvement in this program since 1994.

These fact sheets have been produced for nearly all of the states participating in the STATEMAP program by the Kansas Geological Survey on behalf of the Association of American State Geologists, with funding provided by the U.S. Geological Survey.

This new section can be accessed through the division's home page at <<http://www.state.tn.us/environment/tdg>>. A limited number of color copies are also available by contacting State Geologist Ron Zurawski at (615) 532-1502 or by e-mail at <[Ronald.Zurawski@state.tn.us](mailto:Ronald.Zurawski@state.tn.us)>.

---

### Price Increase for Maps

In response to an administration request that all business functions within state government be operated at break-even or better, the Division of Geology recently increased the price of its geologic and topographic maps. Basic geologic maps and mineral resources summaries are now \$5.00 each. Geologic maps and mineral resources summaries that include mineral resources maps such as coal maps are now \$10.00 each. Out-of-print geologic maps and mineral resources summaries for which Xerox copies must be made remain at \$10.00 each. Topographic maps are now \$6.00 each.

We regret the necessity of these price increases. However, coupled with the closing of our Cowan Street warehouse, at a cost savings of more than \$6,000 per year, this will enable us to cover the cost of operating our maps and publications sales office. Publications that were formerly stored at Cowan will be moved to either our Ellington Agricultural Center warehouse or to onsite storage within our office space in the L & C Tower. Well cuttings that were stored at both Cowan and Ellington will be moved to our core storage and research facility at Waverly, Tennessee.

## **Nominations Sought for Mapping Committee**

The Tennessee Division of Geology will be reconvening the Tennessee Mapping Advisory Committee (TMAC) during the spring of 2002. The Division is currently participating in the federally funded State Geologic Mapping Program Element (STATEMAP) of the National Geologic Mapping Program. The objective of STATEMAP is to accelerate the production of geologic maps of areas in which knowledge of geology is important to the economic, social, or scientific welfare of individual states. The thrust of this effort is to resolve significant socioeconomic issues including urban planning and development, economic minerals, natural resources, and geologic hazards. This program requires that geologic mapping priorities be established by a "multi-representational" mapping advisory panel in each participating state.

The current TMAC includes representatives from the Tennessee Departments of Agriculture, Environment and Conservation, and Economic and Community Development, and from the state's mineral industry, academic community, and environmental consulting community. The Committee first met in 1993 and generated a list of 14 quadrangles to be mapped using STATEMAP funds. To date, Greeneville, Johnson City, Bristol, Lenoir City, Jonesborough, Loudon, Cave Creek, Philadelphia, and Sweetwater have been mapped. Mapping is currently underway on Jackson North, Leesburg, and Sullivan Gardens, and has been approved for Lovelace and Mosheim during Fiscal Year 2002-2003. Therefore no maps remain from the original priority list for consideration in Fiscal Year 2003-2004.

Quadrangles that may be considered during the Committee's next meeting include incomplete and unmapped quadrangles within the

Big South Fork National River and Recreation Area (Barthell Southwest, Gobey, Honey Creek, Huntsville, Oneida North, Oneida South, Pall Mall, Robbins, Rugby, Sharp Place, Stockton, and Winfield), the Hartford Quadrangle (which is adjacent to the Great Smoky Mountains National Park), and quadrangles encompassing the proposed I-69 corridor in West Tennessee (Arlington, Bonicord, Brighton, Brunswick, Covington, Fort Pillow, Fowlkes, Gates, Gift, Millington, Munford, Ripley North, and Ripley South).

In order to ensure that the Committee is not overlooking other critical areas, we would like to solicit suggestions as to which additional quadrangles should also be considered for the next prioritized list. In addition, we are also seeking additional volunteers to serve on the Committee. The next meeting will probably be held in Nashville, and should last no more than half a day. If you would like to serve in this capacity, please indicate your current position and interest.

Please send your nominations for additional quadrangles to be considered, or to serve on the Committee, by no later than April 30, 2002, to:

Ronald P. Zurawski  
Tennessee Division of Geology  
13th Floor, L & C Tower  
401 Church Street  
Nashville, TN 37243-0445  
Phone: 615-532-1502  
Fax: 615-532-1517  
E-mail: [Ronald.Zurawski@state.tn.us](mailto:Ronald.Zurawski@state.tn.us)

Please contact us if you need a list of quadrangles that have already been mapped, or that are currently in process.

## Cover Photo

Although not currently in production, this oil well in Morgan County is typical of Tennessee's nearly 600 "stripper" wells. Averaging only about two barrels of oil per day, they accounted for about 71 percent of the oil and 71 percent of the value of the oil produced in Tennessee during 1999. For more details, please refer to related article on marginal wells.

Photo by Marvin Berwind.

---

### STATE OF TENNESSEE POLICY OF NON-DISCRIMINATION

The Tennessee Department of Environment and Conservation is committed to principles of equal opportunity, equal access and affirmative action. Contact the EEO/AA Coordinator or the ADA Coordinator at 1-888-867-2757 for further information. Hearing-impaired callers may use the Tennessee Relay Service (1-800-848-0298).

---

Tennessee Division of Geology  
13th Floor, L&C Tower  
401 Church Street  
Nashville, TN 37243-0445  
327.11-20200